

The Quine-Duhem Thesis: A Case for Semantic and Methodological Holism?

- Recall (footnote 11, **LectureXXSupplement**) the remark concerning *monism* presupposing *reductionism*, and, in turn, the less-than-obvious connection (perhaps even contingent, in some cases, e.g. Morrison?) between pluralism and reductionism. In this mini-section of the course, we examine a powerful thesis known as the Quine-Duhem (or the Duhem-Quine, according to Gillies) **which combined seems to attack the very (or seemingly) sacred principle often presupposed to underwrite scientific thought and activity: *reductionism*.**
- W.V.O Quine's landmark essay (1951) "Two Dogmas of Empiricism" seeks to go the **very epistemic root** of what he considers to be a central "dogma" of empiricism (including obviously its surrogates evidenced in science and in philosophy of science): the presupposed schism between *analytic* and *synthetic* statements (to be 'precisified' according to Quine in the passage below) and, in turn, the *reductionism* such a presupposition evinces:

Modern empiricism is conditioned in large part by two dogmas. One is a belief in some fundamental cleavage between truths which are ***analytic, or grounded in meanings independently of matters of fact, and truths which are synthetic, or grounded in fact.***¹ The other dogma is ***reductionism: the belief that each meaningful statement is equivalent to some logical construct upon terms which refer to immediate experience.***² Both dogmas, I shall argue, are ill-founded. One effect of abandoning them is, as we shall see, a blurring of the supposed boundary between speculative metaphysics and natural science. Another effect is a shift towards pragmatism. –CC1998, 280

¹ As mentioned by Gillies (CC1998, 312), Quine is using notions of 'analytic' versus 'synthetic' agreed upon by most contemporary philosophers of the 20th century, which are roughly paraphrased as 'true [just] by meaning of words/terms the statement contains' versus 'true according to notions above and beyond the mere meanings of words.' This distinction obviously a **semantic** (recall **Lecture XVIII, II**) notion through and through. This is contrasted with earlier notions like Kant's: that an analytic statement is one whose truth of the predicate is contained in the truth of the subject, (and the opposite in the case of synthetic; i.e. a statement whose truth of the predicate is *not* contained in the truth of the subject) or Frege's more **formal** notion of analyticity: that a statement can be reduced "to a truth of logic by means of explicit definitions." (311)

² This notion of reductionism, however, is metaphysically narrow and contrived. (One need not be a reductionist and believe such: for instance, one could be a Platonic transcendental idealist and believe each meaningful statement is reduced to some correspondence or reference to some transcendental Form, not necessarily directly experienced). Of course, what Quine is presupposing is the reductionism laden with empirical and metaphysical assumptions (of the Locke, Hume, Russell, logical empiricist intellectual lineage). We can of course forgive Quine for this omission, since this form of 'empiricism' is the object of criticism in his essay!

Quine advocates, as suggested in the above passage, a pragmatically motivated *semantic holism*.³

- Pierre Duhem, in the passages from his (1906) *Aim and Structure of Physical Theory* on the other hand critiques what he considers is a ‘fruit’ of science (especially in his specialty: physics): *methodological reductionism*. He advocates in the case of physics a methodological holism:

[T]he demonstrative value of the experimental method is far from being so rigorous or absolute: **the conditions under which it functions are much more complicated than is supposed...the evaluation of results is much more delicate.**

A physicist decides to demonstrate the inaccuracy of a proposition; in order to deduce from this proposition the prediction of a phenomenon and institute the experiment which is to show whether this phenomenon is or is not produced, **he does not confine himself to making use of the proposition in question; he makes use of a whole group of theories accepted by him as beyond dispute.**

The prediction of the phenomenon ...**does not derive from the proposition challenged if taken by itself, but from the proposition at issue joined to that whole group of theories; if the predicted proposition is not produced, not only is the proposition questioned at fault, but so is the whole theoretical scaffolding used by the physicist.** The only thing the experiment teaches us is that among the propositions used to predict the phenomenon and to establish whether it would be produced, *there is at least one error, but where this error lies is just what it does not tell us.* (CC1998, 261, emphases added)

For example, as demonstrated (here in more general terms) by the schema discussed in Gillies (303-305), according to Duhem a physical *theory T* is really a *theory-complex*, i.e.:

$$T \Leftrightarrow T_1 \wedge T_2 \wedge \dots \wedge T_n \wedge A$$

Where: T_1, T_2, \dots, T_n are T 's ‘laws’ or subtheories⁴ and A is totality of T 's ‘background assumptions.’⁵

³ As mentioned by Gillies, however, Quine merely bows in that direction in his essay: “Where Quine does go beyond logic, it is towards pragmatism, though Quine’s pragmatism is usually only mentioned in passing, rather than elaborated [on, in his essay].” (314) Recall **Lecture II**, thanks to Josh Harshmann’s question: Pragmatism is an authentically American philosophical movement developed by C.S. Peirce (who described his brand as ‘pragmaticism’ to distance himself from what he thought William James was doing) and William James. As the term suggests, pragmatic theories of meaning are ‘cashed out’ (to use one of James’ expression) in terms of their pragmatic import: a statement is meaningful insofar as it’s useful to its agent. Pragmatic theories of truth are methodologically holist (and inseparable from meaning) and provisional and immanent (as opposed to final and transcendent): A statement is **true** if it provides a ‘best use in the long run;’ as Peirce mentioned, “one reaches ‘truth’ when one reaches the end of enquiry.”

⁴ Duhem doesn’t distinguish between the two notions. We will in the subsequent sections of this course, dealing with Laws, and Intertheoretic Reduction

Now, if T entails some observation statement O , i.e. if: $T \Rightarrow O$, then according to the contrapositive (recall **Lecture II**):

$$\neg O \Rightarrow \neg T$$

However, using DeMorgan's Law reveals the source of the indeterminacy (for Duhem)

$$\neg O \Rightarrow \neg (T_1 \wedge T_2 \wedge \dots \wedge T_n \wedge A) \Leftrightarrow \neg T_1 \vee \neg T_2 \vee \dots \vee \neg T_n \vee \neg A$$

In other words, a negation of an observation statement O produces an overproliferation of alternatives: **one could negate any of one (or more) of T 's subtheories/laws or the host of background assumptions A .**⁶ And *nothing in T tells us what do here!*

So, for instance, in the cases discussed by Duhem (Newton's laws, theories of optics, 270-273) we see instances in a dispute where some, in defense T_1, T_2, \dots, T_n merely seek to revise aspects of A , while others go further: rejecting T_1, T_2, \dots, T_n as well as aspects of A . Sometimes only the radical latter option is viable

[S]ome of or hypotheses, which taken in isolation defied direct experimental refutation, will crumble with the system it supported under the weight of the contradictions inflicted by reality on the consequences of this system taken as a whole.⁷ (277)

- Harkening to the cases discussed in pp 272-273 by Duhem, Gillies offers an example regarding the discovery of Neptune (308). In both instances, late 19th century astronomers observed a discrepancy (i.e. $\neg O$) in the perihelion advances of Uranus and Mercury not accounted for by the perturbation methods in the Newtonian theory T . Yet in the first case, astronomers (LeVerrier, et. al) hung on conservatively to T_1, T_2, \dots, T_n by postulating in another planet causing the anomaly in the case of Uranus: that planet was later discovered to be Neptune. On the other hand, adopting the same strategy in the case of Mercury (postulating in the existence of a planet 'Vulcan' closer to the sun was for naught, so

⁵ Recall Hawthorne (for those of you who wrote on the first topic in the first assignment) adopts this notion. Hawthorne cleaves A from assumptions directly constituting T . Of course, for writers like Kuhn, this is not so clear. Note the inspiration here: For Kuhn, Duhem's T is an example of a **paradigm** or **disciplinary matrix**. For example, if T is the Newtonian (celestial mechanical theory) and T_1, T_2, \dots include the 4 laws of Newton (3 laws of force + gravity) *as well as* Kepler's 3 laws, then A is necessary, since otherwise "If Newton's theory is correct, Kepler's laws are necessarily false." (268) A includes the mathematical perturbation techniques (i.e. Lakatos'es 'auxiliary conditions') as well as the rules for building telescopes, which is itself founded on *another* theory-complex T' (optics), etc. (269)

⁶ To drive this point especially home, note that "or" (\vee) (recall **Lecture II**) is *inclusive*. One could do both!

⁷ Kuhn of course describes this as a *scientific revolution*.

eventually *all* of T had to be negated, replaced by T' (Einstein's General Theory of Relativity) which beautifully accounted for perihelion advance.⁸

- Duhem advocates a spirit of '*le bon sens*' in which he favors the radical strategy: suspending one's belief in T_1, T_2, \dots, T_n . Unfortunately, this was a strategy he practiced without preaching, according to Gillies. Though Duhem's (1906) writings seem to practically anticipate Einstein's theories of special and general relativity (1908, 1914) on a silver platter, he excoriated both of them (due, according to Gillies, to much unfortunate WWI literature manifesting as French anti-German propaganda, and vice versa). He condemned Einstein's theories as part of the 'deviant German' mentality of trumping common sense.⁹ Though according to Gillies, this historical issue only partly explains Duhem's recalcitrance:

Duhem was a man of outstanding logical ability; yet as a physicist, he was a failure....[i]n almost every scientific controversy in which he was involved, he chose the wrong side. (310)

- After picking apart all the characterizations of analytic/synthetic attempted by Carnap and others, Quine's semantic holism is offered according to his famous web/field metaphor:

The totality of our so-called knowledge or beliefs...is a man-made fabric which impinges on experience only at the edges...**total science is like a field of force whose boundary conditions are experience...the total field is so underdetermined by ...experience, that there is much latitude of choice as to what statements to reevalutate in the light of any single contrary experience.** (296)

- Gillies cobbles together Quine's and Duhem's holism by qualifying Quine's holism with the 'local action' of Duhem's *le bon sense* (part **B**, 317) while at the same time acknowledging Quine's epistemic holism as applicable to 'high level' theoretical entities in any science. (part **A**, 317) Hence (a la Gillies, the Duhem-Quine thesis)

⁸ In Kuhn's terms: the *anomaly* in the previous theory became the *exemplar* in the succeeding theory.

⁹ Unfortunately for Einstein and fortunately for the USA, as he and other esteemed mathematicians fled, the German Nazis of course attacked his theories on similar *ad hominem* grounds.